REMARKS

Enclosed is a revised version of the Abstract on a separate sheet of paper in compliance with M.P.E.P. § 608.01(b).

Claim 1 has been amended for clarity and to remove the word "plaited." Support for claim 1 as now amended can be found on page 3, lines 25-32 of the specification. Claim 3 has also been amended to make it consistent with claim 1. No amendments have been made in view of the cited prior art.

Applicants' invention as set forth in amended claim 1 relates to a two-way warp knitted fabric:

a) that is formed by knitting a polytrimethylene terephthalate yarn in the front and elastic yarn in the back of the fabric;

b) and which knitted fabric has a knitted fabric density ratio from 1.55 to 2.35, the fabric density ratio being calculated from the following formula:

knitted fabric density ratio = [(the number of courses/2.54 cm)] / [(the number of wales/2.54 cm)].

Based on features a) and b), the present invention provides a two-way warp knitted fabric that is soft to the touch, that is free from yellowing, and in which the occurrence of curling is substantially prevented. See the specification at page 6, line 29 to page 7, line 13.

The claimed knitted fabric density ratio is the density ratio of the knitted fabric subsequent to dyeing and finishing. When the knitted fabric density is less than 1.55, curls tend to be formed in the right and left portions in the weft direction of the two-way fabric. When the knitted fabric density ratio is larger than 2.35, curling tends to occur in the upper and lower end portions in the warp direction thereof. A preferred fabric

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density ratio is from 1.65 to 2.25. See the specification at page 7, lines 14 to 21; and page 9, lines 4 to 8.

Within this knitted fabric density ratio, the soft feeling specific to a polytrimethylene terephthalate (PTT) yarn is maintained on the knitted fabric surface, and in the two-way warp knitted fabric, curls are suppressed. Further, these features can be obtained without deterioration of important processing features, such as heat formability or gigging tendency. In contrast, in a two-way warp knitted fabric having its front formed with nylon or polyethylene terephthalate (PET) fiber, resultant relevant features are not as satisfactory. See the specification at page 9, lines 9 to 20.

The two-way knitted fabric can be prepared by:

(A) knitting a grey fabric from a polymethylene terephthalate yarn and an elastic yarn having a fabric density ratio from 1.55 to 2.35 on a warp knitting machine, with the runner length/rack of the elastic yarn being larger in comparison with the runner length in a knitted union fabric of a nylon or polyethylene terephthalate yarn and a elastic yarn (see page 7, line 33 to page 8, line 12);

(B) pre-setting the grey fabric on a tenter so that the fabric density ratio falls within the range satisfying feature b) above prior to or after scouring (see specification at page 8, lines 12 to 21); and

(C) finishing the fabric subsequent to dyeing by setting it with approximately the same density as the width and length subsequent to dyeing or with the same density ratio as in presetting (see specification at page 8, lines 21 to 24).

As shown in Tables A and B, and Figure A attached, the physical properties of PTT yarn noticeably differ in (1) initial modulus, (2) elongation, (3) elastic recovery of

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elongation, and (4) thermal stress of the yarn from those of a nylon yarn and a PET yarn. These properties significantly influence important features of the fabric made from these yarns.

The low initial modulus and the high elastic recovery of elongation of PTT yarn makes a fabric of PTT yarn feel softer than a fabric of PET yarn. However, the high elongation and high elastic recovery of PTT yarn will make a knitted fabric structure have a greater residual stress. This makes the knitted fabric become curly. The thermal stress generated in a PTT yarn is double that of PET and nylon yarns. This property of PTT yarn makes the knitted fabric structure hard and uneven, but stable when thermally processed.

In the Office Action, the Examiner rejected claims 1 and 2 under 35 U.S.C. § 103(a) for being obvious over Lumb et al. (Lumb) in view of Kimura et al. (Kimura), and also for being obvious over Lumb in view of Hirt et al. (Hirt). Claim 3 was rejected over Lumb & Hirt further in view of Morifuji et al. (Morifuji). Reconsideration of the rejections in light of the following is requested.

Lumb describes a composite fabric having the capability of removing moisture away from the skin. The composite fabric includes a first fabric layer comprising either a polyester or nylon yarn which has been rendered hydrophilic, and a second fabric layer comprising at least 25% by weight of a moisture absorbent material, such as cotton. The composite fabric may be constructed as a warp or weft knit, such as two-end fleece, three-end freece, terry with regular plaiting (note: plait knitting is a form of weft knitting in which two different yarns are knitted in such a manner that one yarn becomes the face of the knitted goods and the other the back thereof), double terry,

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double needle raschel, and tricot (column 2, line 63 to column 3, line 2). The polyester yarn (or nylon yarn) is rendered hydrophilic when the composite fabric is dyed using a dyebath containing a low molecular weight polyester additive (column 3, line 63 to column 4, line 26). The first fabric layer and the second fabric layer are formed concurrently by knitting a plaited construction so that the layers are distinct and separate, yet integrated with one another. The second fabric layer is then coated with an aliphatic-polyester polyurethane blend to promote resistance to pilling; the polyurethane blend not affecting the absorbency of the layer (column 4, lines 38 to 48).

In the Example, a knit with terry construction, 23 wales/inch and 30 courses/inch, is knitted on a circular knitting machine. The knitted fabric has a moisture absorbent layer comprising 90% cotton and 10% rayon and a polyester layer comprising 100% 2.2 denier polyester, 150 denier textured yarn. The polyester layer comprises 61% by weight while the moisture absorbent layer comprises 39% by weight (column 4, lines 52 to 65). Figure 1 of Lumb shows a composite fabric in the form of a terry knit structure capable of creating a moisture concentration gradient which serves as the driving force to move (or transport) moisture through the fabric away from the surface of the fabric (column 5, lines 24 to 36). The composite textile fabric is used for inner linings, out-wear, and athletic garments (column 1, lines 5-30). Use of a generic polyester yarn is referred to, but the specific use of polytrimethylene terephthalate yarn is not described.

Kimura et al. describes a high twist polyester multifilament yarn for use in producing a woven or knitted crepe fabric having a pebble configuration. The polyester multifilament yarn consists essentially of a copolymer of two or more monomers selected from the group consisting of ethylene terephthalate, trimethylene terephthalate,

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and tetramethylene terephthalate and/or a blend of two or more polymers of the respective monomers, and having a breaking elongation of not more than 60% and shrinkage in boiling water of not more than 6%. The trimethylene terephthalate is introduced into the copolyester fiber to set thermally the torque imparted by high twist for development of the desired pebble configuration. The polyester multifilament yarn is imparted with high twist and then the highly twisted yarn is subjected to a twist setting treatment and then converted into a woven or knitted yarn. The fabric is then subjected to pebbling treatment.

As noted above, the claimed two-way warp knitted fabric is a fabric formed by knitting a PTT yarn in the front and an elastic yarn in the back of the fabric. Since the knitted fabric has elastic yarn knitted in the warp knitted structure, it exhibits elastic elongation in both the warp and weft directions.

On the other hand, the composite textile fabric of Lumb has a plaited knit construction, including a hydrophobic first fabric layer formed of nylon or polyester yarn and a second fabric layer formed of a moisture-absorbent material, such as cotton. Significantly, the knit composite fabric of Lumb does not include an elastic yarn. While the knitted fabric can be treated with a polyurethane blend, this does not amount to the use of an elastic "yarn" in the knitted fabric. The polyurethane coating is merely applied to the face of the moisture-absorbent layer to give a coating of urethane resin that imparts non-pilling characteristics to the fabric, not to give it elastic properties.

While the composite fabric of Lumb is of a terry construction, a variation of plaited knit construction formed by a weft knitting system, the knit construction is of all

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non-elastic yarns. Moreover, according to the specification in column 4, lines 52 to 55, the knit density of the composite fabric is 1.30.

In contrast, the two-way warp knitted fabric of the present invention includes an elastic yarn and the fabric density ratio is from 1.55 to 2.35. In a warp knitted fabric, the non-elastic component yarn, i.e., the PTT yarn, substantially wraps the knit loops of elastic yarn by the elastic elongating function inherent to elastic yarn. This is the generally observed state of a loop of elastic yarn in the knit structure of a two-way warp knitted fabric. Lumb teaches that his composite fabric may be a warp knitted fabric, but contrary to the Examiner's comments, there is no teaching of a stretchable composite fabric containing an "elastic yarn."

Thus, while the Examiner may believe it would be obvious to substitute the PTT yarn of Kimura for the generic polyester yarn of Lumb, even if this was true, the combination of Kimura and Lumb still fails to teach applicants' claimed invention. As required by M.P.E.P. § 2143, to establish a *prima facie* case of obviousness, the prior art references relied on by the Examiner must teach or suggest at least in combination all of the claimed limitations.

As noted, neither reference teaches the claimed knitted fabric density or a knitted fabric which includes an "elastic yarn." While the Examiner acknowledges that the density is not taught by either reference (page 3, lines 4-5 of the Office Action), nothing is mentioned about the failure of the references to teach the presence of an "elastic yarn." The Examiner appears to be believing that treating (i.e., coating) the face of the fabric with a polyurethane blend will give it an "elastic quality" and that somehow this is equivalent of an "elastic yarn." However, not only does Lumb not teach that such a

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coating will give it an "elastic quality" (it is for non-pilling purposes), but clearly it will not make the fabric stretchable, which is an inherent characteristic of a knitted fabric that contains "an elastic yarn."

Withdrawal of the rejection of claims 1 and 2 over Lumb in view of Kimura for failure of either reference to teach a knitted fabric containing an elastic yarn is therefore requested.

The same is true with respect to the rejection based on Lumb and Hirt. Hirt describes a process for coloring polytrimethylene terephthalate fiber with a disperse dye in the absence of a carrier and the application of pressure, i.e., at a temperature not exceeding 100°C. Numerous examples of stretched polytrimethylene terephthalate fibers from various examples of the polymers are described together with their tensile properties. The examples of dyeing fabric are carried out using the stretched fiber converted to knitted fabrics in the form of knitted hose (10 cm in diameter) knitted by a circular knitting machine. However, there is no teaching in Hirt like in Kimura of combining the PTT yarn in a knitted fabric with another fiber yarn, let alone an elastic yarn.

Withdrawal of the rejection of claims 1 and 2 over Lumb in view of Hirt is therefore also requested for the same reason related to Lumb and Kimura.

Moreover, while the Examiner in both of the above noted rejections maintains that though none of references teach the claimed density that this would be obvious because discovering an optimum variable of a result effective variable involves only routine skill in the art, this claimed range of knit density in the two-way warp knitted fabric is necessary to prevent curl in the right and left end portions in the weft direction

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of the fabric, and in the upper and lower portions in the warp direction of the fabric. No suggestion whatsoever, let alone a suggestion to maintain a specific density ratio is taught in any of the references for preventing this problem. Within this range, the two-way knitted fabric retains the soft feel specific to a PTT fiber, which PET does not have, and maintains its important processing features such as shaping ability as well as surface uniformity. This cannot be achieved in a two-way knitted fabric of nylon yarn or PET yarn and an elastic yarn.

In this regard, reference is made to Table 1 on page 23 where two-way knitted fabrics within the claimed knit density range, made of a nylon yarn or a polyethylene terephthalate yarn and an elastic yarn are compared (Comparative Examples to 5 to 9) with one made of a PTT yarn. Note with reference to Table 2 on page 24, that the fabric containing nylon yarn or PET yarn was inferior compared to one containing PTT yarn with respect to curling tendencies or, if not, was inferior in feel and gigging tendency. Overall the fabrics of PTT yarn were superior. Thus, the claimed knit density range is not a parameter simply to create a sturdier and tighter fabric, but to create a composite high performance fabric not obtainable in a conventional two-way knitted fabric made of nylon or PET yarn and an elastic yarn. Consequently, the determination of the claimed knit density is not the discovery of an optimum value of a result effective variable and it is therefore not obvious to one of routine skill in the art.

For this additional reason it is believed claims 1 and 2 are not obvious over Lumb in view of Kimura or in view of Hirt.

Finally, with respect to Morifuji, this reference may teach a two-way warp knit fabric of a non-elastic yarn and a polyurethane elastic yarn using a half tricot stitch.

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However, it appears nothing is taught in the reference about using even a polyester yarn let alone a PTT yarn in the knitted fabric (only the very generic term "synthetic fiber" as nylon fibers are preferred) or the claimed fabric density ratio which provides specific properties to the knitted fabric of a PTT yarn and an elastic yarn. Thus, the reference fails to teach any of the features missing in both of Lumb or Hirt. Consequently claim 3 should not be considered obvious over this combination of references either.

It is believed claims 1-3 are in condition for allowance and such action is therefore requested.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
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Dated: June 5, 2003

By: _____
Arthur S. Garrett
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Table A Comparisons of Fiber characteristic

	PTT	PET	N6	N66
Melting point (°C)	230	258	220	260
Glass transition point (°C)	51	69	78	76
Density (g/cm^3)	1.34	1.38	1.14	1.14
Moisture regain (%)	0.4	0.4	4.5	4.5
Tenacity (g/d)	3.8 - 4.2	4.2 - 4.8	4.7 - 5.1	5
Elongation %	36 - 42	30 - 38	32 - 44	38
Initial Modulus (at 3% elongation)	25	84 - 95	30 - 32	52
Elastic recovery (at 20% elongation)	88	25 - 26	64 - 65	62
Thermal stress (g/d)	0.38 - 0.45	0.16 - 0.18	0.19 - 0.21	0.25
Shrinkage at boiling water	11 - 14	6 - 8	9 - 11	7
Birefringence $\times 10^{-3}$	1.64	1.7		1.58

PTT: Polytrimethylene terephthalate

PET: Polyethylene terephthatate

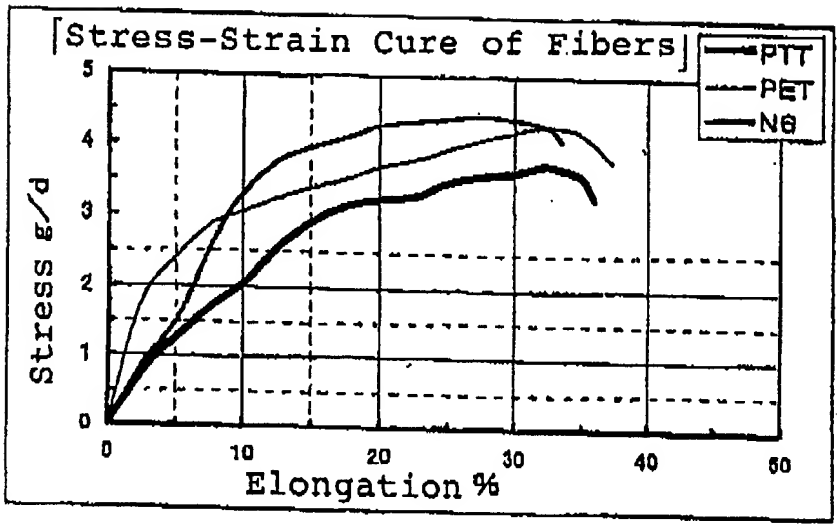
N6: Nylon 6 (Polycapramide)

N66: Polyhexamethylene adipamide

Table B Comparison of recoveries at elongations (%), and stress at stated elongations

		Producer's yarn		
		5% elongation	10% elongation	20% elongation
PTT 50d/24f	Recovering (%)	100	100	88
	Stress (g/d)	1.2	2.1	3.3
PET 50d/24f	Recovering (%)	42	45	25
	Stress (g/d)	2.3	3.1	3.7
N6 70d/24f	Recovering (%)	100	95	65
	Stress (g/d)	1.5	3.3	4.2

Figure A


[Stress-Strain Cure of Fibers]
PTT
PET
N6
Stress g/d
0
1
2
3
4
5
0
10
20
30
40
50
Elongation %

APPENDIX TO AMENDMENT OF JUNE 5, 2003

Version with Markings to Show Changes Made

Amendments to the Claims

1. (Amended) A two-way warp knitted fabric which is formed by [plaited] knitting a polytrimethylene terephthalate yarn in the front and an elastic yarn in the back of the fabric of the fabric and which has a knitted fabric density ratio from 1.55 to 2.35 calculated from the following formula:

knitted fabric density ratio = [(number of courses)/2.54 cm]/[(number of wales)/2.54 cm].

3. (Amended) The two-way warp knitted fabric according to claim 1, wherein the warp knitted [texture] fabric is formed with a half tricot stitch.

Amendments to the Abstract

[ABSTRACT]ABSTRACT

A two-way warp knitted fabric which is a knitted fabric having a warp knitted fabric construction formed by knitting a polytrimethylene terephthalate yarn in the front and an elastic yarn in the back and which has a knitted fabric density ratio from 1.55 to 2.35 calculated by the following formula.

knitted fabric density ratio = [(number of courses) /2.54 cm]/[(number of wales)/2.54 cm] (1)

[ ]The knitted fabric is a stretchable knitted fabric material for clothing in which curl formation is suppressed, which gives a soft feeling, and which does not yellow.

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